

Claims

What is claimed is:

1. A valve actuation system, comprising:
an engine valve moveable between a first position at which the engine valve prevents a flow of fluid relative to the engine valve and a second position at which the fluid flows relative to the engine valve;
a first cam adapted to move the engine valve from the first position to the second position during a first lift period in response to a rotation of the first cam;
a second cam adapted to move the engine valve from the first position to the second position during a second lift period in response to a rotation of the second cam; and
a cam following assembly disposed between the first and second cams and the engine valve, the cam following assembly adapted to selectively connect one of the first and second cams with the engine valve to thereby move the engine valve through one of the first and second lift periods.
2. The valve actuation system of claim 1, wherein the cam following assembly includes:
a first cam roller selectively engagable with the first cam;
a second cam roller selectively engagable with the second cam;
a cam follower base;
a first cam lever pivotally connecting the first cam roller to the cam follower base; and
a second cam lever fixably connecting the second cam roller to the cam follower base.
3. The valve actuation system of claim 2, further including:

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a bore disposed in the cam follower base;

a piston slidably disposed in the bore, the piston adapted to move between a first piston position at which the piston is retracted relative to the cam follower base and the first cam controls the movement of the cam following assembly to move the engine valve through the first lift period, and a second piston position at which the piston extends from the bore to engage the first cam lever to cause the second cam to control the movement of the cam following assembly thereby executing the second lift period;

a reservoir adapted to store a supply of fluid;

a source in fluid communication with the reservoir and the bore via a fluid passageway; and

a control valve disposed between the bore and the source, the control valve movable between a first control valve position at which fluid is prevented from flowing between the source and the bore and a second control valve position at which fluid flows between the source and the bore causing the piston to move from the first piston position to the second piston position.

4. The valve actuation system of claim 3, further including a controller configured to move the control valve between the first control valve position and the second control valve position.

5. The valve actuation system of claim 3, further including a return spring adapted to bias the piston towards the first piston position.

6. The valve actuation system of claim 3, further including a bleed valve disposed in a fluid passageway between the bore of the cam follower base and the supply.

7. The valve actuation system of claim 3, further including a restrictive orifice disposed between the source and the supply.

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8. The valve actuation system of claim 3, wherein the piston moves in a direction perpendicular to the first cam lever motion to block the first cam lever in an extended position.

9. The valve actuation system of claim 1, further including a rocker arm operatively connected with the engine valve and a push rod operatively connected between the cam following assembly and the rocker arm.

10. A method of actuating an engine valve having a first position at which the engine valve prevents a flow of fluid relative to the engine valve and a second position at which the fluid flows relative to the engine valve, comprising:

rotating a first cam having an outer surface adapted to move the engine valve between the first position and the second position during a first lift period;

rotating a second cam having an outer surface adapted to move the engine valve between the first position and the second position during a second lift period; and

operating a cam following assembly to selectively connect one of the first and second cams with the engine valve and moving the engine valve through one of the first and second lift periods.

11. The method of claim 10, wherein operating the cam following assembly includes:

directing a pressurized fluid to a bore in the cam following assembly to move a piston into engagement with a first cam lever to connect the second cam with the engine valve; and

releasing the pressurized fluid from the bore to connect the first cam with the engine valve.

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12. The method of claim 11, further including allowing the pressurized fluid to leak past the piston in the bore to allow the piston to retract into the bore.

13. The method of claim 11, further including opening a bleed valve to allow the piston to retract into the bore.

14. A valve actuation system, comprising:
an engine valve moveable between a first position at which the engine valve prevents a flow of fluid relative to the engine valve and a second position at which the fluid flows relative to the engine valve;
a first cam adapted to move the engine valve from the first position to the second position during a first lift period in response to a rotation of the first cam;
a second cam adapted to move the engine valve from the first position to the second position during a second lift period in response to a rotation of the second cam; and
a cam following means for selectively connecting one of the first and second cams with the engine valve to thereby move the engine valve through one of the first and second lift periods.

15. The valve actuation system of claim 14, wherein the cam following means includes:

a cam follower base;
a first cam lever pivotally connecting the first cam roller to the cam follower base; and
a second cam lever fixedly connecting the second cam roller to the cam follower base.

16. An engine, comprising:

a block defining a combustion chamber;

a crankshaft;

a valve actuation system including:

an engine valve operatively associated with the combustion chamber and moveable between a first position at which the engine valve prevents a flow of fluid relative to the combustion chamber and a second position at which the fluid flows relative to the combustion chamber;

a first cam adapted to move the engine valve from the first position to the second position during a first lift period in response to a rotation of the crankshaft;

a second cam adapted to move the engine valve from the first position to the second position during a second lift period in response to a rotation of the second cam; and

a cam following assembly disposed between the first and second cams and the engine valve, the cam following assembly adapted to selectively connect one of the first and second cams with the engine valve to thereby move the engine valve through one of the first and second lift periods.

17. The engine of claim 16, wherein the cam following assembly further includes:

a first and second cam roller;

a cam follower base;

a first cam lever pivotally connecting the first cam roller to the cam follower base; and

a second cam lever fixedly connecting the second cam roller to the cam follower base.

18. The engine of claim 17, wherein the valve actuation system further includes a locking device having:

a bore disposed in the cam follower base;

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a piston slidably disposed in the bore, the piston adapted to move between a first piston position at which the piston is retracted relative to the cam follower base and the first cam controls the movement of the cam following assembly to move the engine valve through the first lift period, and a second piston position at which the piston extends from the bore to engage the first cam lever to cause the second cam to control the movement of the cam following assembly thereby executing the second lift period;

a reservoir adapted to store a supply of fluid;

a source in fluid communication with the reservoir and the bore via a fluid passageway; and

a control valve disposed between the bore and the source, the control valve being movable between a first control valve position at which fluid is prevented from flowing between the source and the bore and a second control valve position at which fluid flows between the source and the bore, said flow causing the piston to move from the first piston position to the second piston position.

19. The engine of claim 18, wherein the valve actuation system further includes a controller configured to move the control valve between the first control valve position and the second control valve position.

20. The engine of claim 18, wherein the valve actuation system further includes a return spring adapted to bias the piston towards the first position.

21. The engine of claim 18, wherein the valve actuation system further includes a bleed valve disposed in a fluid passageway between the bore of the cam follower base and the supply.

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22. The engine of claim 18, wherein the valve actuation system further includes a restrictive orifice disposed between the source and the supply.

23. The engine of claim 18, wherein the piston moves in a direction perpendicular to the first cam lever motion to block the first cam lever in the extended position.

24. The engine of claim 17, further including a rocker arm operatively connected with the engine valve and a push rod operatively disposed between the first lever of the cam following assembly and the rocker arm.

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